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CONTENTS

THE GEOLOGICAL SURVEY OF CHINA

IN the process of reconstruction, and adaptation to modern conditions, which China is at present undergoing, the introduction of scientific research and, concurrently, the establishment of scientific government organs is absolutely essential to the success of the movement. To a narrow circle of interested mining men and scientists, it has long been known that the Geological Survey of China, established in 1916, has been making steady progress, both in the way of supporting the mining industry with expert advice, and in accumulating scientific data and material to such an extent that it has been recognized abroad as a factor in inaugural ceremonies by and in the presence ploration of the earth.

But the work of the Geological Survey has been carried on in quite an unostentatious way, and little has transpired about its activities outside of professional circles, until July seventeenth, when the institution was officially thrown open to the public, with appropriate inaugural ceremonies by and in the presence of H. R. President Li Yuan Hung.

Before giving an account of these exercises, it may be well briefly to review the development of the survey and its achievement up to the present time.

Geological Government Surveys have been established during the last half century in all civilized states. The principal aims of those institutions are threefold: namely, (1) to promote the knowledge of the mineral resources of the country, (2) to carry on a general geologic survey of the whole country upon a uniform scale, and (3) to undertake scientific geological research.

In the first of these fields the Geological Survey of China can already point to a creditable series of achievements, such as the discovery and survey of a large number of iron-

ore deposits, which will soon be described in a monographic report, and the examination of numerous coal-fields, as well as metalliferous deposits. Among the latter are the antimony and mercury deposits, which have already been described in the bulletins issued by the survey.

The general geological survey of the country has so far been restricted to the province of Chihli, Shantung, Shansi, Bonan, and Kiangsu, the larger part of those provinces being already mapped. It is the intention of the survey to publish sheet maps of the whole of China upon the scale of one to one million, and four such sheets are now in preparation.

The scientific work of the survey has been confined principally to the study and description of the fossil remains occurring in the various geological systems, and to the determination of stratigraphic horizons. The survey has had the advantage of the cooperation of a famous paleontologist, Dr. A. W. Grabau, formerly professor of paleontology at Columbia University, who has made great progress in describing the invertebrate fossils.

A number of Swedish scientists, acting as associate paleontologists to the survey, have, with the Swedish fund, made extensive collections of fossil plants, fossil mammals and the remains of prehistoric man, and these are now being studied by them. The results of these studies, together with Dr. Grabau's investigations on the invertebrate fossils, will be published in "the Paleontologic Sinica," a series of monographs, which is intended to comprise, as far as possible, descriptions and illustrations of all the fossils of China.

Early in the history of the survey, the collections brought together by the field geologists, were arranged to form a small museum. This has grown constantly, until now it comprises 3,250 specimens of ores, minerals, rocks and fossils, properly labeled and exhibited under glass, in the compound of the Survey west city, Fong Shong Hutung, No. 3.

In order to bring together an up-to-date geological library, the director of the survey, Dr. V. K. Ting, approached private individuals as well as mining companies, requesting them to contribute to a library fund. Through their generous response, forty thousand dollars were collected, and with this fund Dr. Ting has been able to erect a modern library building and bring together a collection of geological literature comprising at present 8,873 volumes. President Li Yuan Hung has taken a leading rôle among the individual donators, while among the mining companies the Kailan Mining Administration stands foremost through the generosity of its donation.

It has been considered by the minister of agriculture and commerce, and by the director of the Geological Survey, that this institution has now reached such a stage of development that it is appropriate to throw the museum and the library open to the public. The opening ceremony took place on the seventeenth instant at four o'clock in the afternoon, in the lecture hall of the survey, and in the presence of a distinguished gathering of Chinese officials, headed by President Li Yuan Hung, who, himself a leading donor to the library fund, gave, by his presence, renewed evidence of his scientific interest and democratic spirit. Among other notable guests, we may specially mention the minister and vice-minister of agriculture and commerce, Their Excellencies Chang Kuo Kan and Chiang Tion To; the chiefs of the different departments of the ministry of agriculture and commerce; and delegates from other government museums in Peking, as well as many of the donators and other representatives of the mining industry.

The guests were welcomed by the director of the survey, Dr. Ting, in the following words:

"H. E. the President, Their Excellencies, the Minister and the Vice-Minister, our honored guests and my colleagues: It is my great privilege and pleasure to welcome you most heartily on behalf of the Geological Survey. First of all, I must thank the president, not only because he condescends to come to this ceremony, but also because he is one of the contributors to our building fund. In foreign countries it is not uncommon for the official head of the state to be present at the opening of a similar scientific institution, but, as far as I know, this is the first time in China that the President of the Republic honors such an occasion by his presence. This indicates the scientific interest as well as the democratic spirit of our president, for which we are sincerely grateful.

"Secondly, I must thank the donors to our

building fund. Without their generous help we would be still without a library. Furthermore they have come here to-day in spite of this very hot weather, so that we may have an opportunity to thank them publicly, and to show them what we have done with their money. It proves the real interest they take in our institution. I may add that this is also the first time that private generosity has helped a scientific institution belonging to the government.

"Thirdly, I must thank my official superiors in the ministry of agriculture and commerce. In spite of the political changes that have taken place, they have always given us their support. They have not only provided us with sufficient funds in the time of great financial stringency, but they have also left to their responsible subordinate a great deal of freedom in administration, and in the appointment of the staff. Thus, with the exception of three men in charge of the business part of the institution, practically all the members are technical men. Again there is not a single extra man appointed beside the regular members, whose number is determined by the rules of the organization. Whatever result we have been able to achieve is entirely due to the confidence and guidance of our superiors.

"Fourthly, I take this occasion to thank the members of my staff for their loyal cooperation. Because of the smallness of the staff, we are not able to put men solely in charge of the library and the museum. Practically every member has done his part, in order to render this opening possible. During this summer all have worked, through all the day, instead of only half a day, as in most of the government bureaus, and recently they have even worked on the national holidays and on Sundays. I therefore tender to both my foreign and Chinese colleagues my personal gratitude, and desire to tell our guests frankly that the results of the survey, such as they are, have been the work, not of one or two men, but of all the members of the organization.

"For a summary of the history and the functions of the Geological Survey I refer you to the printed pamphlets. I wish only to tender to you once more our sincere thanks, before I respectfully request the President to deliver his address."

Following Dr. Ting's welcoming remarks, H. E. the President of China declared the Geological Survey Library and Museum opened to the public in the following words:

Geology is by no means a new science in China; indeed, it originated here in very ancient times. In the book of Yu, the nature and color of soils were carefully discriminated. In the Chow Dynasty, a mining and geographical staff formed an important branch of the government organization. The book of Kweitzu touches even on the principles of ore deposition and the manner of locating ore deposits. Since the Dynasty of Han and Wei, trained specialists on copper and silver were constantly employed by the government. Though their knowledge was fragmentary, and their results frequently inconsistent with modern ideas, we can not help thinking that the achievements of those pioneer workers entitles them to be considered as forerunners of the great army of investigators in the modern science of geology. It is only because of the lack of system in the methods of study of the ancient Chinese, that we are at present far behind other countries in this branch of science. As a result of this neglect in the development of this important branch of knowledge, our people remain poor and miserable, because we are not equipped with the necessary knowledge to develop our vast resources, which are at present almost untouched.

As is well known, geology is most intimately related to mining, while mining is the foundation of a nation's prosperity. Important and fundamental though they are, our government has paid no attention to such investigations until very recently.

The Geological Survey of China was organized in 1913, two years after the revolution. Having spared no efforts to overcome the many and serious obstacles in its path, this survey has now reached its present enviable position. This is due entirely to the efficient administration of its officers, and the ambitious labors of all its members. Under almost all kinds of difficult conditions, the members of the survey have willingly and earnestly enlisted to perform their duty—the work of collecting facts and materials, the mapping of many districts, and the study of the various problems connected with the mining industry. Recently the survey has purchased a large number of books in Europe, America and Japan, to serve the needs of its ever growing activities. In 1920 the new museum and library were established, this being made possible by contributions from outside sources. With these facilities, the survey is now able to arrange, in systematic manner, all the minerals, ores, rocks, fossils and books collected from time to time.

To-day is the opening day for the public exhibition of the newly established museum and

library, and I have the great honor to be present on this occasion. I found in the library books on diverse phases of the science of geology and its kindred subjects, well classified and arranged, and in the museum, specimens of almost all the varieties of minerals, rocks and fossils of this country, accompanied by descriptive matter and illustrative maps and sections. It is really a wonderful and marvelous exhibit. I am very sure that both the industrial and the scientific world will be greatly benefitted by the existence of such an organization as this. May I congratulate you, my dear members of the survey, on the success of your work, and the opportunity you have for the future development, in this country, of science and industry—for those are the foundations of our nation's prosperity.

The next speaker was H. E., Chang Kou Kan, the minister of agriculture and commerce, who spoke as follows:

Geological investigation of the country is a technical and scientific subject, as well a necessary branch in the government organization. In order to lay the foundation for industries depending on natural resources, and to point the way for their development, such investigation is absolutely essential. When I myself served as the head of the ministry in former times, I tried hard to promote this kind of investigation. Owing to the lack of funds, however, this organization was not able to expand as it should have. Now the President has taken the lead, followed by many of our mining people, in contributing towards the building of the library, and the expansion of the museum. All signs indicate that the nation as a whole places great hopes in the Geological Survey. It is to be expected that the survey will expand its work, and to complete the geological atlas, and the geological maps of the important mining regions, so that both the industrial and the scientific world will be profited. Thus we shall be able to realize what the president has so earnestly hoped for. Great credit is also to be given to those who have made contributions towards the realization of this aim. Such cooperation between private individuals or companies and the government is perhaps the first of its kind ever practiced in this country.

The next address was delivered by the vice-minister of agriculture and commerce, H. E., Chiang Tien To, who expressed himself as follows:

The main duty of our ministry is to develop our natural resources, thereby making our country a prosperous one. There are many ways that lead to this desired end, but the survey of the geology of the country is one of the most important. In the study of geology we must pay attention not only to field work, but we must also carry on scientific research work. It is for this reason that the geological surveys of other countries are all equipped with modern libraries and museums. The museum of this survey has been established for many years and I have personally visited it several times. I found in it specimens of ores and rocks from all parts of China, furnishing a very good foundation for research. Owing to lack of funds, the survey has not been able previously to build a library. Now the president has taken the lead, together with many gentlemen prominent in the industrial and mining circles of this country, in contributing to this survey the funds which have made possible the erection and equipment of this building. From now on the members of the survey, besides doing field work, will also be able to carry on accurate research work under adequate conditions. I am sure that the results thus obtainable will be profitable to both the industrial and the scientific world. It is hoped, therefore, that the members of the survey will work with renewed enthusiasm, and give of their best, so that the high hopes of the president and the minister may be realized to their fullest extent.

Mr. C. Y. Yen, the industrial commissioner of Chihli, spoke next and expressed his admiration of the work already accomplished by the Geological Survey, not only in building up a very efficient organization but also in contributing actively to the industrial development of Chihli province.

Mr. E. J. Nathan, the representative of the Kailan Mining Administration, the largest donator among the mining companies, expressed his deep satisfaction with the well arranged museum and considerable library which the survey had already been able to bring together. He was convinced that the Geological Survey of China, which had already done so much for the discovery and survey of mineral deposits, will in the future prove a powerful factor in the development of China's mineral industry.

General Yen Chang, formerly minister of war, explained in an eloquent address the importance of the systematic examination and development of the rich treasures which are hidden in the rocky ground of China. The effective organization of the Geological Survey

gives good hope that the public will have excellent scientific help in the promotion of the national mineral industry.

After the opening ceremony the president, followed by the other guests, made a tour of inspection of the library and of the museum.

H. T. CHANG,
Acting Director

PEKING,
JULY 17, 1922

AGGLUTINATION AND TISSUE FORMATION

FOR a considerable number of years the principle underlying our analysis of tissue formation—undertaken with the view of contributing to a physiology of tissues in contradistinction to a physiology of organs[1]—was the suggestion that primarily agglutination is the factor which makes isolated cells join into a tissue, and that this agglutination depends on a certain consistency of the outer layer of the cell protoplasm[2]. In an analysis of tissue formation it was thus necessary to determine the factors on which this consistency depends and we showed that it is a quantitatively variable factor, that this variability is a prerequisite in amœboid movement and that the same agglutinability which determines tissue formation is the cause of what we have called stereotropism of tissue cells, their tendency to move in contact with solid surfaces.[2] Tissue formation, stereotropism and amœboid movement are therefore related phenomena, all depending on a certain variability and regulation in the consistency of the outer layer of the protoplasm. As a step in this investigation we prepared an experimental amœbocyte tissue which consists of motile bloodcells of invertebrates and which readily admits of an experimental analysis of all these associated factors.[3] The basic laws of tissue formation must apply equally to the various kinds of growth, embryonic, regenerative, correlative and tumor growth.[4]

Tissues are primarily aggregates of agglutinated cells. Secondarily certain differentiations may occur which concern the individual cells as well as the connections between these cells. Elementary tissues and even structures resembling particular tissues in certain respects, can be produced from isolated amœbocytes under conditions which we have described in detail elsewhere. Under the influence of environmental changes the consistency of the outer protoplasmic layer of these cells is altered in such a way that it becomes sticky. In this experimental tissue various processes which occur in natural tissues can be imitated. A state of the outer parts of the protoplasm intermediate between liquid and solid is essential for tissue formation, because it insures that degree of adhesiveness necessary for this process. Agglutination is likewise the basic factor, which insures the possibility of the formation of paraplastic structures in which the products of adjoining cells are united into a homogeneous whole.

We showed that the movements of tissue cells take place in contact with surfaces which are solid or approach the solid state, such as fibres. We designated this mode of reaction as stereotropism of tissue cells (1898), and attributed to it a significant part, not only in wound healing, but also in processes taking place normally in the organism whenever movements of tissue cells occur.[5] This stereotropism is apparent not only in normally motile cells, but even in cells which are normally in a fixed condition but which are made to move under conditions which imply a change in environment; it is self-evident that this includes also those environmental changes which take place during embryonal development. We found that this stereotropic reaction can

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[2] Washington University studies 1920, VIII, 3. *American Journ. Physiol.* 1921, LVI, 140. SCIENCE 1921, LIII, 261.

[3] Washington University Studies, 1920. VIII. 3 SCIENCE 1919 L. 502. *American Journal Physiol.* 1922, LX, 277.

[4] Virchow's Archiv. 1903, CLXXIII, 135. *Journ. Med. Research*, 1917, XXXII, 75, 1920, XLI, 247. *Journ. Cancer Research*, 1920, V, 261. SCIENCE, 1922, LV, No. 1410.

[5] Archiv. f. Entwickelungsmech. 1898, VI, 297. 1902, XIII, 487. *Anatomical Record*, 1912, VI, 109. M. S. Fleischer and Leo Loeb. Proc. Soc. Exp. Biol. and Med., 1911, VIII, 133.